

Atmospheric Erosion Caused by Stellar Coronal Plasma Flows on Terrestrial Exoplanets Within Close-in Habitable Zones of Low Mass Stars

Helmut Lammer (helmut.lammer at oeaw.ac.at), Space Research Institute, Austrian Academy of Sciences, Schmiedlstr. 6, A-8042 Graz, Austria

Maxim Khodachenko, L., Space Research Institute, Austrian Academy of Sciences, Schmiedlstr. 6, A-8042 Graz, Austria

Yuri Kulikov, N., Polar Geophysical Institute (PGI), Russian Academy of Sciences, Khalturina Str. 15, Murmansk, 183010, Russian Federation

Herbert Lichtenegger, I. M., Space Research Institute, Austrian Academy of Sciences, Schmiedlstr. 6, A-8042 Graz, Austria

Naoki Terada, National Institute of Information and Communications Technology, Nukui-Kitamachi, Koganei, Tokyo, and CREST, Japan Science and Technology Agency, Saitama, Japan

Thomas Penz, Istituto Nazionale di Astrofisica, Osservatorio Astronomico di Palermo Giuseppe S. Vaiata, Palermo, Italy

Low mass M stars show a higher level of stellar activity compared to solar-like stars, and because of the close orbital distance of their habitable zones (HZs) compared to that of the Solar System, terrestrial exoplanets within M star HZs will be much stronger influenced by stellar winds and dense plasma ejected from the host star by Coronal Mass Ejections (CMEs). The efficiency of atmospheric erosion of CO₂-rich exoplanets, with the size and mass similar to that of the Earth, due to dense stellar plasma flows within close-in habitable zones of active M-type dwarf stars is investigated. Since M-stars are active at the X-ray and EUV radiation wavelengths over long time periods we have applied a thermal balance model at various XUV flux input values for simulating the thermospheric heating by photodissociation and ionization processes, due to exothermic chemical reactions and cooling by the CO₂ IR radiation in the 15 micron band. Our study shows that intense XUV radiation of active M-stars results in atmospheric expansion and extended exospheres. Using thermospheric neutral and ion densities calculated for various XUV fluxes, we applied a numerical test particle model for the simulation of atmospheric ion pick up loss rates from an extended exosphere of magnetized and non-magnetized Earth-like exoplanets and discuss the consequences of our results for the evolution of habitable planets within active M star environments.